

I. PROJECT PURPOSE

A. Problems: Watersheds in urban areas challenge the nation's ability to manage the needs of both the natural and city environment. Watersheds have been damaged. In the San Francisco Bay Estuary, only remnants of the original wetlands remain, while nearly 95% of the Bay Area's riparian habitat has been damaged or destroyed.¹ This has resulted in problems of water quality, depletion of habitat, diminished biodiversity, and loss of native species.

City residents are at risk. Residents of low-income communities located near factories, freeways, power plants, and sewage stations experience the health problems of environmental degradation associated with urbanization. Only recently, for example, have scientists and planners begun to address the higher rates of cancer, asthma, and lead poisoning suffered by those living in these harshly impacted areas. In addition, as housing expands into wilderness areas, homes and individuals are at greater risk from natural processes, as was tragically evidenced in the 1991 Oakland Hills firestorm that began in the urban/wildland interface, left 25 people dead, destroyed nearly 3,000 homes, and caused \$1.5 billion of damage. The need to better integrate nature into our urban environments is also driven by broad social and economic goals—to improve the quality of life for all urban residents and to revitalize urban neighborhoods.

Community leaders in the Bay Area have indicated that widespread community understanding and involvement is vitally important to confront these complex problems. In recent decades, numerous neighborhoods and citizen groups have become involved in efforts to reclaim green space and transform blighted areas. However, many low-income communities remain less involved. Several obstacles prevent broader community participation: 1) a limited number of program activities specifically designed to engage and excite city residents; 2) a need for better environmental education and training in the schools and community; and 3) a lack of access to integrated information and better means to use it.

B. Solutions: The goal of the *City Watershed* project is to increase community involvement in and understanding of the urban watershed so that citizens, students, teachers, and community leaders can contribute solutions to the interrelated environmental and social problems in the Bay Area's watershed. We will accomplish this goal through three major project components: strong partnerships, engaging technology-mediated watershed programs, and the implementation of a watershed contribution exchange system.

1. Partnerships: The *City Watershed* project brings together 15 key university, community, city, regional, and federal partners concerned with the urban watershed. We will create two regional clusters of programs—one in the East Bay and one in San Francisco. In each region we will carry out program activities at two or three "watershed learning laboratories" and in the classrooms of community and education partners. The "watershed learning laboratories" consist of field locations along watersheds that run from the hills (park and public land) through city settings to the bay and wetlands. Wireless networks will be set up in one "laboratory" in each region. (See Map of Project Scope, Appendix A.)

The University of California, Berkeley, Interactive University Project will manage overall project activities. In each regional cluster there will be lead partners. In the East Bay, the UC

¹ *Restoring the Bay*, The San Francisco Bay Joint Venture, 2001.

Berkeley College of Natural Resources and the Urban Creeks Council will coordinate program activities in Richmond, Berkeley, and Oakland. They will be joined by the Ma'at Youth Academy, the City of Berkeley, the East Bay Municipal Utility District, the East Bay Regional Park District, the United States Department of Agriculture Research Service, and the Oakland Unified School District. In San Francisco, the Urban Watershed Project and the Crissy Field Center will lead program activities in the Tennessee Hollow and Lobos Creek watersheds. They will be joined by the Presidio Trust, the National Park Service, the San Francisco Estuary Project, and the San Francisco Unified School District. (See Overview of Partners, Appendix B.)

2. Watershed Programs: In the two regions partners will enhance existing and create new program activities using an integrated suite of digital technologies to encourage community participation. Programs will be organized in the following major categories:

- *Community-based Environmental Research and Surveys*: High school students, for example, will gather watershed data using personal digital assistants (PDAs), Global Positioning System (GPS) technology, and the web.
- *Watershed Restoration*: Families will engage in ecosystem restoration (daylighting creeks, removing invasive exotic species, replanting native species, cleaning up neighborhood parks and wetland areas); they will document their work using digital cameras and video technology.
- *Watershed Analyses, Recommendations, and Narratives*: Community advocates will use spreadsheets and presentation software to develop and present neighborhood environmental recommendations before local watershed and city planning boards. As a complement to this analytic approach, community members will also be able to use weblogs and digital storytelling to build narratives and personal reflections about the city watershed to be shared with others.
- *Trainings, Workshops, Institutes*: A series of training programs and workshops will be held for community leaders, teachers, and youth, to support theses research, restoration, and interpretation activities.

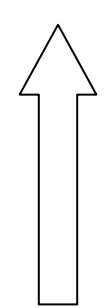
3. Watershed Contribution Exchange System (the *Exchange*): Supporting all of these program activities will be a web-based content sharing environment that will (1) enable all project partners and end users to contribute, find, collect, create, and share data and content about the city watershed; (2) be a place for community members to find opportunities to participate in environmental activities and for partners to share program updates; and (3) serve as a growing, historical record of survey, restoration and analysis activity. Partners such as university libraries and research centers, local governments, municipal water districts, and the National Park Service will contribute watershed data on an on-going basis. End users will use the *Exchange* to access such resources as maps, plant and insect identification slides, historical photos, and water quality data. They will also be able to post their own contributions: environmental data they have gathered with PDAs, photo collections documenting a neighborhood stream and park clean-up, and/or watershed recommendations and digital stories. The *Exchange* will include unique content collection, manipulation, and annotation tools that the Interactive University Project is developing (the "Scholar's Box") to make it easier for individuals and groups to build their own custom collections of watershed content. Finally, the *Exchange* will use XML technologies so that content its objects can be marked up with metadata and/or annotations. This will allow partners and end users to build translations, key words, and pointers into content objects so they are structured for use by multiple community audiences.

C. Outcomes: *City Watershed* seeks to realize four outcomes:

1. Participation and Understanding: Over the two and a half years of the project, 1000 new community members from diverse socio-economic backgrounds will participate in watershed education, survey, and/or restoration activities. Approximately 700 of these participants will achieve a measurable increase in knowledge and skills about the city watershed and digital technologies used to address environmental problems. We will focus in particular on urban youth. Fifty teachers from San Francisco and Oakland schools will receive hands-on training in inquiry-based methods of teaching environmental science using local resources.
2. Contributions to Improving the City Watershed: Restoration activities will lead to significant improvements in water quality, the balance of native and urban species, city clean-up, the integration of nature into urban environments, and better habitat for various flora and fauna. Watershed analyses, policy recommendations, and local narratives will help many community residents provide input to city administrators and watershed resource managers.
3. Sustainable Regional Collaborations: Project partners will establish a sustainable model for on-going collaboration in the development and administration of environmental programs.
4. System for Sharing City Watershed Content: The *Watershed Contribution Exchange* system will be established as an on-going web environment used by project partners and community members throughout the Bay Area. It will be integrated into the daily work of key project partners. It will be made available nationally as an open-source software tool.

II. INNOVATION

The nature, scope, and balance of the suite of five major digital technologies powering the *City Watershed* project are innovative and important for the national effort to use information technologies to address community problems (see figure 1 below).



	Mobile and Interpretive Technologies	Authoring and Interpreting Tools	Digital storytelling and video production, weblogs, soundscapes, PowerPoint presentations, spreadsheets, graphs, and charts
		Field Tools and Networks	PDA's, digital cameras and audio recorders, data loggers and portable water quality testers, GPS and wireless network(s)
	<i>Watershed Contribution Exchange</i> System	Lens	GIS and other views
		Web Content Collection, Transformation, Sharing Environment	"Scholar's Box" - an access and authoring environment (in development)
		Content Architecture	XML structured content for community use

Fig.1 A schematic diagram of technologies powering the *City Watershed* project.

The foundation of the suite of technologies is an XML-based content architecture, enabling materials to be structured, marked-up, and made accessible for multiple communities via an array of tools. The IU's Scholar's Box, a web-based content management tool, allows the collection, manipulation, and re-use of digital content objects from multiple sources, and will interoperate with multiple digital repositories and authoring and interpreting technologies. A GIS-based interface provides a powerful and intuitive lens to sharpen understanding of data and other content. The *Watershed Contribution Exchange* will be built using these three layers: an XML content architecture, the Scholar's Box for content management, and GIS for the primary data view. Interacting with the *Exchange*, mobile digital media technologies (PDA's with GPS,

and digital cameras) give end users tools to gather and analyze field data. Wireless networks at East Bay and San Francisco “watershed learning laboratories” enable end users to interact in real time with the *Exchange*. Finally, personal authoring and interpreting technologies, such as weblogging and presentation software, allow end users to construct and present city watershed narratives, analyses, and digital stories. (See Technology and Content Diagram, Appendix C.)

Several projects funded by TOP in past years have pioneered technologies to be implemented by the *City Watershed* project, and this project will benefit from their experiences. The Gulf of Maine Aquarium's *Vital Signs* program distributes hand-held computers equipped with probes, digital cameras, and Global Positioning System capability to end users who gather data and add it to a growing on-line database². The Minneapolis Neighborhood Information System builds a database of public housing information for urban residents to access using GIS and provides tools to track the health of the housing supply and develop housing strategies.³

City Watershed builds on these efforts but adds several other critical enhancements and technologies. First, the Scholar's Box tool in the *Exchange* enables end users not only to access content, but to create and manipulate custom collections of digital objects. The Exchange focuses on learners and end users as creators and authors—not simply consumers—of content. Second, the project's *Exchange* will interoperate with a range of partner digital repositories so that new content can regularly flow in. Third, the project includes weblogging and digital storytelling (short digital movies built primarily from still images, music, text and voice) so that end users have more tools for telling personal stories and reflection. The project seeks to strike a balance between large-scale content exchange technologies and more personal narrative tools. Fourth, and importantly, the project uses XML (extensible mark-up language) as a foundational technology for the wrapping and handling of all content. XML, a key tool of the second generation “semantic” web, will allow the project to add metadata and annotations to much of its content so that materials can be more easily found, used, and shared by multiple audiences. An important objective and innovation of this project is to bring XML technologies, currently primarily being used in the private sector, to community organizations, and demonstrate how these technologies can be used by non-profit and educational organizations.

III. COMMUNITY INVOLVEMENT

A. Partnerships: The *City Watershed* project benefits from the partnership of 15 organizations (see Overview of Partners, Appendix B). A strong series of interlocking relationships, resulting from previous collaborations, exists among project partners. Partners each bring unique assets and expertise; their roles, benefits, and contributions to the project are summarized in the following table:

Partner	Roles	Benefits	Contributions
Higher education: UC Berkeley (Interactive University, College of Natural Resources, other	Lead project; involve 20 faculty, students; share research content; run some program activities;	Stronger connection to community and K-12 schools; service learning, research	Faculty, student, staff time; facilities; and technology totaling \$608,100 of cost share.

² TOP award # 23-60-02008; grant information on-line at http://ntiaotiant2.ntia.doc.gov/top/2002/details.cfm?tiap_no=20163.

³ TOP award # 27-60-01019; grant information on-line at http://ntiaotiant2.ntia.doc.gov/top/2002/details.cfm?tiap_no=10224.

campus departments, libraries and museums)	develop <i>Exchange</i> ; lead evaluation.	opportunities for UC Berkeley students.	
Community based organizations: Urban Creeks Council, Urban Watershed Project, Crissy Field Center, Ma'at Youth Academy, SF Estuary Project	Co-lead project; lead activities in East Bay and SF; involve end users; facilitate use of field tools (e.g., PDAs, GPS); provide content to <i>Exchange</i> .	More participants, new technologies to strengthen programs; access to new and integrated environmental and city data/content.	Staff, facilities, and tools totaling \$217,693 in cost-share.
Local government: City of Berkeley	Approve and facilitate public projects; provide data and content.	Strengthened local economies; increased engagement of citizens.	Support and participation of city staff; sharing of data.
Regional resource agencies: East Bay Municipal Utility District, East Bay Regional Park Dist.	Enable access to field sites (e.g., Tennessee Hollow in the Presidio of SF); contribute management resources and professional staff to educational and restoration efforts; provide content & data.	Greater public support and involvement; stronger partnerships, esp. with educational systems; help with data gathering, monitoring of watershed ecosystems; increased policy input from youth and community constituencies.	Access to land, management resources, and professional staff of federal agencies are a valuable contribution that cannot, by rule, be documented through cost-share.
Federal government: National Park Service, Presidio Trust, USDA Agricultural Research Service.			
K-12 schools: Oakland Unified School District, San Francisco Unified School District	Guide development of educational aspects of program; involve 50 teachers and hundreds of students	Increased opportunities for inquiry-based study, stronger science & env. education programs.	Support of district leaders and teachers on special assignment; facilities totaling \$77,659 in cost-share

Partnerships in this project will be maintained through a collaborative structure that includes a steering committee made up of representatives from all partners that meets quarterly; a management team that meets monthly; and six working groups (see Management Structure, Appendix D).

B. Community Involvement: The *City Watershed* project derives from an extensive series of discussions among community stakeholders, a number of whom are partners in the project. Letters of support from these partners attest to their interest and enthusiasm (see Letters of Support, Appendix G). The project's community watershed partners, along with the College of Natural Resources (CNR), have been central to the design process. It is their innovative programs on which the project builds; and their need to reach greater numbers of participants, their desire for richer collaborations with educational and governmental partners, and their enthusiasm for the new activities and technologies, that have shaped the project. These groups have a proven understanding of the needs of individual end users. The Crissy Field Center, for example, developed its initial programs through a two-year community outreach process, and, like CNR, has fine-tuned these programs through years of service.

C. Support for End Users: The end users of the *City Watershed* project are citizens, urban youth, K-12 students, higher education students, teachers and faculty, community advocates, and public- and private-sector watershed and environmental practitioners. The project's partners will recruit these end users, whose backgrounds reflect the diversity of life experiences and skills

found among Bay Area residents. Partners already serve similar users through existing programs in a variety of settings. They introduce youth to environmental science, and help them recognize the school and career opportunities available in environmental and related fields. They help youth and adults experience the benefits of involvement in scientific, policy, and planning debates, and empower residents by giving them tools to address their own problems, such as the capability to collect data and to accurately translate their findings for use in policy and advocacy arenas. The community, school, and higher education partners in this project, building on their experience and existing program structures, will develop training and technical support programs as part of core program activities and the *Watershed Contribution Exchange*.

IV. EVALUATION AND DISSEMINATION

A. Evaluation: The *City Watershed* project will utilize a logic model evaluation strategy to address identified evaluation questions and to determine whether program activities are achieving the desired four outcomes (see Appendix E, Logic Model and Evaluation). This strategy is particularly effective with complex initiatives, such as improving environmental awareness and conditions. By laying out interim measurable outcomes on the way to long-term outcomes, logic models provide an effective way to chart the progress of complex initiatives and make adjustments along the way. For each of the *City Watershed* project's four outcomes, we have developed evaluation questions, an evaluation strategy, and data collection and analysis methods. These are described in Appendix E.

Dr. Deborah McKoy, on the faculty at UC Berkeley's City and Regional Planning and Education Departments, will conduct the evaluation. She has 10 years experience conducting program evaluation at local, city and nationwide levels of analysis. She recently completed an evaluation of the National Science Foundation's Urban Systemic Program with the SFUSD. Dr. McKoy specializes in community education and participatory planning projects working with universities, community-based organizations, schools, and governmental offices. She will be assisted by graduate students and receive substantial support from the project management team.

B. Dissemination: There is a need nationally for systems that allow citizens and organizations to find, modify, contribute, and share information about urban watersheds, especially data and content from the agencies involved in addressing environmental and urban development issues. Information about the *City Watershed* project and its *Watershed Contribution Exchange* will be disseminated widely. UC Berkeley will make the *Exchange* available as a free, open-source software tool. Content deposited within the *Exchange* will be available for use, as well. *City Watershed's* project structure and program strategies should provide a model for collaboration among organizations in many localities.

City Watershed has designated a communications coordinator, created a communications and dissemination team, and allocated significant funds, including travel and supplies, to share information, host conferences, and present papers. Professional staff, teachers, and faculty from the project's partners will share the project's work at national forums such as the Society for Ecological Restoration, the Association of Bay Area Government's Annual State of the Estuary Conference, the O'Reilly Emerging Technology Conference, National Educational Computing Conference (K-12), Educause (higher education), and the National and/or California Science Teachers Association. UC Berkeley will publicize the project through the *IU News*, the monthly

on-line newsletter of the Interactive University, and other campus publications. We will ensure that the project and *Exchange* are linked from many web sites in the Bay Area and nationally.

V. PROJECT FEASIBILITY

A. Technical Approach: We have chosen technology components that are, as much as possible, industry standards, extensible, scalable, inexpensive, and, as applicable, open-source: web-based applications; XML for data exchange; Linux, Apache, MySQL, and PHP for software development; Internet and 802.11b networks; and weblogging for easy web site creation. We are using low-cost commodity level PDA and GPS devices. We will build the *Watershed Contributions Exchange* by using technologies already in development at UC Berkeley (especially the Scholar's Box) and contribute most of the technical development as cost share. Content for the Exchange will come primarily from existing digitized resources housed in a number of libraries and digital repositories. (We note that *City Watershed* is neither principally a software nor content development project.) We have chosen technologies that work with and complement each other, for example, GIS adds value to XML; PDAs working with the *Exchange* allow mobile access to information. We have chosen tools, based on research and/or project partner experience, that have demonstrated potential to be highly beneficial for our end user community. City Watershed partners, especially UC Berkeley, will integrate the *Exchange* into on-going program and system development activities beyond the life of the grant.

B. Qualifications: Project partners are highly qualified organizations with the necessary expertise to carry out the project, including: a long track record of developing community programs; a deep understanding of environmental watershed issues; responsibility for managing watershed resources and policy; experience in engaging students and the public in environmental education programs; leadership in science education professional development; experience in university-community-school partnerships; technical competence with XML, web-based content management systems, GIS, weblogs, digital storytelling, and other tools; and experts in program evaluation. The Interactive University Project has won awards from the Department of Commerce Technology Opportunity Program (exemplary evaluation model), Housing and Urban Development (best practices in community networking), the Berkeley campus, and Educause (national model) for its work using technology to engage the campus with K-12 schools and the community. Through grants from TOP and other federal departments and agencies (Departments of Education and Housing and Urban Development, National Science Foundation), the Interactive University has proven itself a skilled manager of projects of this scale. The project has set up a reasonable management structure to assure clear roles, responsibilities, and accountability; the budget includes significant amounts of time (through funded positions and through cost-share) for programming, administration, technology, education and training, evaluation, and communication and dissemination.

Paul Gray, the project's Principal Investigator, is UC Berkeley's Executive Vice Chancellor and Provost; he will ensure high level campus support. **David Greenbaum**, Project Director, is Director of Berkeley's Interactive University Project, and has led university-school-community technology partnerships for the campus for seven years. **Donald Dahlsten**, Faculty Coordinator for the College of Natural Resources, has served as Associate Dean for educational outreach and has a long history of working with local and regional partners. **Mark Spencer**, East Bay Program Coordinator, has led watershed restoration projects with the Urban Creeks Council for seven years. **Doug Kern**, San Francisco Program Coordinator, founded and leads the Urban

Watershed Project in the Presidio of San Francisco. **Rick Jaffe**, Program Manager and Technology Team Coordinator, has over 20 years experience carrying out community education programs using video and web technologies. Other faculty, graduate students, technology staff, and school district and community staff will carry out essential project duties. They are listed in the Personnel Summary (Appendix F) and Budget Narrative.

C. Implementation: The project activities will be implemented according to the following plan:

Oct-Dec '03 - Program formation: Implement management structure; clarify phase 1 programs and activities; begin development of *Exchange*; start evaluation.

Jan-Aug '04 - Program implementation—Cycle 1: Carry out first round of watershed survey/research activities and restoration activities using PDAs, GPS, digital cameras; test version 1 of the *Exchange* and populate with initial content; carry out training institutes for youth, community leaders, citizens, and teachers, including summer institutes; continue evaluation.

Sep '04-Sep '05 - Program implementation—Cycle 2: Carry out second round of survey/research and restoration activities, modified by results of first round assessment; use *Exchange* as source and recipient of data and content; add watershed analysis, interpretation, and recommendation activities; roll out additional *Exchange* functionality; expand summer institutes; report on mid-project findings at conference(s); carry out extensive evaluation activities.

Oct '05-Mar '06 - Program wrap-up—Complete final program activities; hold sustainability workshops; complete final program evaluation; report at conference(s).

The *City Watershed* project does not share sensitive information. Contributors and copyright owners give approval for publishing their materials before any content is added to the *Exchange*. The project uses common Internet data security mechanisms.

Sustainability beyond the grant period rests upon the strong commitment for this project demonstrated by the community of partners, and upon the centrality of the project to their work. UC Berkeley and other agencies have a long-term commitment to the efforts and partnerships embodied by the project. A number of partner organizations are using fund sources for project support that will continue after this grant ends. It is anticipated that the *Exchange* will become a tool embedded in the day to day work of the partner organizations. The system is constructed from inexpensive computer components, peripheral devices, and software so that future costs can be incorporated into the operating budgets of these groups.

VI. PROJECT BUDGET

Total project costs are \$1,552,160, with \$648,708 requested from TOP and \$903,452 in cost share. The budget is well balanced between university and community partners and represents a strong commitment from all partners to ensure project success. See the detailed Budget Narrative.